WHAT IS CLAIMED IS:

1. A coherent light source, comprising:

a two-electrode laser diode provided with an active region having an active layer that emits light due to injection of a current, and a phase control region that has a layer that is contiguous with the active layer and in which a change in refractive index is caused by injection of current; and

an optical waveguide device in which a distributed Bragg reflector (hereinafter, abbreviated as DBR) region is formed;

wherein laser light that is emitted from the two-electrode laser diode is coupled optically into an optical waveguide of the optical waveguide device, and a portion of the laser light that is emitted from the two-electrode laser diode is reflected by the DBR region and returned to the two-electrode laser diode, thereby locking an oscillation wavelength.

2. The coherent light source according to claim 1,

wherein an emission end face of the two-electrode laser diode and an incidence end face of the optical waveguide device are in opposition to one another, and the laser light emitted from the two-electrode laser diode is optically coupled directly into the optical waveguide of the optical waveguide device.

3. The coherent light source according to claim 1,

wherein the laser light that is emitted from the two-electrode laser diode is coupled optically into the optical waveguide of the optical waveguide device via an optical fiber.

4. The coherent light source according to claim 1,

wherein the phase control region has an active layer that is contiguous with the active layer of the active region and that has been disordered, so that an injection of current causes a change in refractive index but does not cause laser oscillation.

5. The coherent light source according to claim 1,

wherein the optical waveguide device is a wavelength conversion device that employs second harmonic generation.

6. The coherent light source according to claim 1,

wherein an electrode is formed in the phase control region, and by applying current or voltage through the electrode, a phase state inside a resonator of the two-electrode laser diode is changed.

7. The coherent light source according to claim 2,

wherein the DBR region is disposed substantially adjacent to the emission end face of the laser diode-side.

8. The coherent light source according to claim 1,

wherein an inactive region in which the active layer has been disordered is formed in an end face portion of the two-electrode laser diode, and current is not injected into the inactive region.

9. The coherent light source according to claim 5,

wherein a wavelength difference between a phase matching wavelength of the wavelength conversion device and a DBR wavelength of the DBR region is not more than 2 nm.

10. The coherent light source according to claim 5,

wherein in an operation temperature range, a phase matching wavelength of the wavelength conversion device is longer than a DBR wavelength of the DBR region.

11. The coherent light source according to claim 1,

wherein the optical waveguide device is an optical modulator.

12. A method for driving a coherent light source according to claim 1,

wherein a current and a voltage that are supplied to the DBR region and the phase control region are changed simultaneously to allow an oscillation wavelength of the laser diode to be changed continuously.

13. A method for driving a coherent light source according to claim 1,

wherein modulation of an output intensity of the laser diode is performed by changing a current and a voltage that are supplied to the active region and the phase control region at reversed phases.